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35. VARIABILITY IN *BALANITES ROXBURGHII* PL. IN THE INDIAN DESERT

INTRODUCTION

Morphological variability in fruit and seed has some adaptive value for plants in different habitats. Polymorphism is an adaptive trait in arid environment which is characterised by extremes of temperature, low erratic and variable rainfall, high evaporation rates and different soil types. Such variable stress conditions and gene exchange through cross pollination have generated more variability. This desert region is also a centre of diversity/origin of crops like *Vigna acontifolia*, *Cyanopsis tetragonoloba*, *Zizyphus mauritiana* and *Carissa congesta* (Singh *et al.* 1963).

Balanites aegyptiaca Del. is thought to have originated in Nile valley, but is now widely distributed in Africa and Asia (Davis *et al.* 1983). The Indian plant *B. roxburghii* Pl. has a wide ecological amplitude and is common all over western Rajasthan except in the extreme north western part of the state where the annual rainfall is below 200 mm. Its fruits are a source of diosgenin, a precursor for the synthesis of sex hormones, cortico-steroid drugs, anabolic agents and anti-fertility compounds. The seeds contain about 45% oil and seed meal with high amount of protein. The study of the ecological distribution of the plant in western Rajasthan has led to the collection and identification of 50 types from ten sites located in four districts. The type was based on the fruit shape and size. The leaves were

also collected to find if correlation exists between shape/size of fruit and leaf.

MATERIAL AND METHODS

An exhaustive survey was conducted in the districts of Sirohi, Pali, Jodhpur, Barmer and Jaisalmer, to collect fruit and leaf material from *Balanites* trees. At least 20 fruits and leaves were collected from each tree. Observations were recorded on fruit weight, length, width, circumference, volume, weight, length, width of stone and seed (after removal of pulp and endocarp) and leaflet length and breadth. The mean, standard deviation and coefficient of variation values were estimated for each character observed. Correlation analysis was done for length, breadth, size index and shape index characters of fruit and leaflet. Length \times breadth gave size index while length divided by breadth gave shape index.

RESULTS AND DISCUSSION

Among an exhaustive collection of fruits from several sites, at least fifty types have been identified based on fruit characters. A great amount of variability with respect to fruit length, width, circumference, weight, volume and diosgenin content existed (Table 1). The size and shape of the stone and seed resembled to that of the fruit. The size and shape of the leaflets of the fifty types also

MISCELLANEOUS NOTES

exhibited variation. The estimation of standard deviation and co-efficient variation showed existence of considerable variation in the observed characters. Volume followed by weight of fruit revealed the highest coefficient of variation and fruit width the lowest. In case of leaflet, length exhibited a lower variation coefficient compared to breadth (Table 2). A particular type of fruit may occur in different sites. For example, long fruits are seen to occur in almost all locations. Dhola (Pali dt.) had the maximum number of types (Table 2A) Sucker-propagated trees bore the same type of fruits of the parent tree. Hence, the existing variability is genotypic. The species is also

TABLE 1

RANGE OF VARIATION IN FRUIT SIZE AND SHAPE AND DIOSGENIN CONTENT IN FRUIT PULP

Parameter	Range
Length	2.6-8.2 cm
Width	2.2-6.3 cm
Circumference	7.0-19.4 cm
Weight	6.0-80.0 g
Volume	5 -106 cc.
Diosgenin content	0.1-5.6 %

TABLE 2

VARIABILITY ANALYSIS OF FRUIT AND LEAF CHARACTERS OF THE 50 TYPES

Characters	Mean	SD	CV %
Weight (g)	27.53	12.27	44.56
Length (cm)	4.97	1.07	21.48
Width (cm)	3.72	0.67	18.03
Fruit			
Size index	18.71	5.87	31.37
Shape index	1.36	0.35	25.59
Circumference (cm)	11.78	2.07	17.58
Volume (cc)	34.46	18.64	54.09
Leaf			
Length (cm)	3.45	0.65	18.93
Breadth (cm)	1.67	0.45	26.84

TABLE 2A

LOCATIONAL SOURCE OF THE TYPES DESCRIBED

Type code	Location	District
01-07	Devlia	Jodhpur
08-09	Luni	"
10-13	Pal	"
14-20	Osian	"
21-24	Kailana	"
25-	Megalasiya	"
26-28	Balotra	Barmer
29-37	Dhola	Pali
38-43	Sheoganj	Sirohi
44-50	Sirohi	"

cross pollinated, by insects. It is such genetic variability that provides a rich assortment of biotypes bringing more microsites into the ecological amplitude of the species. *Balanites* is distributed from a sub-humid area (Abu-Kozra) in extreme south to arid areas (Balotra, Osian).

In *Citrullus colocynthis*, Pareek and Vashishtha (1980) reported a great amount of variability in fruit volume, seed number per fruit, per seed weight and oil content in this region. Seed variability has been recorded in *Crotalaria medicaginea* (Bohra and Sen 1974) and diversity in size, weight and number of seeds in *Cucumis callosus* (Bansal and Sen 1978).

Statistically, highly significant correlation has

TABLE 3

CORRELATION BETWEEN LEAF AND FRUIT CHARACTERS

Characters (Leaf VS fruit)	Correlation coefficient
1. Length	0.56**
2. Breadth	0.57**
3. Size Index	0.54**
4. Shape index	0.45**

(** highly significant at 1% level)

been established between leaf and fruit characters (Table 3). Correlation coefficient was highest with respect to breadth and lowest in case of shape index.

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36. ADDITIONAL REPORTS OF THE ASTERACEAE FOR PUNJAB STATE

Nair (1978), in his most recent and comprehensive work dealing with the Punjab plants, has recorded 62 wild and 6 cultivated species of the Asteraceae. Subsequently, Daniel (1982) reported *Glossocardia bosvallea* (Linn. f.) DC. from Garhimanswal (Dist. Hoshiarpur). Based upon the plant explorations of Punjab for seventeen years (1963-1979), I enumerated another 16 wild (Sharma 1982a) and 41 cultivated species (Sharma 1982b) of the Compositae from Punjab State. Further collections and observations for six years (1980-1985) from the unexplored and underexplored Shivaliks and submountainous zone of this area have resulted in the recording of another 8 species listed below alphabetically with some relevant observations and annotations. All the specimens cited here are deposited

in Herbarium Punjabi University, Patiala (PUN).

1. *Adenostemma lavenia* (Linn.) O. Kuntze, *Rev. Gen. Pl.* 1: 304. 1891; Raizada, *Suppl. Fl. Upp. Gang. Plain* 100. 1976; Babu, *Herb. Fl. Dehra Dun* 237. 1977. *Verbesina lavenia* Linn. *Sp. Pl.* 902. 1753. *Adenostemma viscosum* J. G. Forst. *Char. Gen. Pl.* 90. 1776; Hook. *f. Fl. Brit. Ind.* 3: 242. 1881, *pro parte*.

Occasionally met with in marshes on the northern side of the State particularly towards Shivaliks. This species is characterized by 1-1.5 mm long corolla, 5-6 mm long heads, 3-4 mm long involucre and tuberculate achenes. Hooker (loc. cit.) had described seven varieties under *A. viscosum*. Plants from our area are referable to var. *parviflorum* (Bl.) Hook. f. However, Hooker (loc. cit.) reduced *A. micro-*